

UNITED STATES GOVERNMENT

Memorandum

TO : Regional Director, Minneapolis, Minn.

DATE: April 6, 1965

FROM : Refuge Manager, Lake Andes Refuge,
Lake Andes, South Dakota

SUBJECT: Annual Water Management Plan

Attached is the corrected Annual Water Management Plan.

The calculations regarding the inflow-outflow data were computed by totalling the loss for each month, thereby obtaining the sum total of evapo-transpiration loss for the entire year. It appears Engineering calculated only net loss, i.e., January gauge reading minus December gauge reading.

Peter S. Suich
Peter S. Suich

Attachment

APR 8 1965	
REG. DIRECTOR	
SECY. TO R.D.	
INFO. OFFICER	
WRITING CLERK	
ADMIN. OFFICER	
PROP. MGR.	
BUDGET & FIN.	
PLANNING	
CRIM. INV.	
LABORATORY	
TRAINING	
RECORDS	
MAIL ROOM	
CLERICAL	

MS *Jan*

LAKE ANDES NATIONAL WILDLIFE REFUGE
Lake Andes, South Dakota

ANNUAL WATER MANAGEMENT PLAN - 1965

A. Existing Water Supply.

Unit	Gauge Reading*	Management Level	Maximum Level	Inflow (Approx.)	Outflow (Approx.)
North	1134.50	1136.26	1137.25	None	None
Center	1134.16	1134.85	1137.25	None	None
South	1134.00	1134.85	1137.25	None	None
Owens Bay	1140.14	1141.12	1141.52	750 g.p.m.	None

Staff gauges have been installed on all units. Direct mean sea level readings are now in effect.

* Last three digits indicate actual gauge reading.

Lake Andes proper is divided into three units by two dikes. The North Dike, which separates the North Unit from the Center Unit, has a control structure on the east end and a newly constructed emergency spillway and channel on the west end. The South Dike separates the Center Unit from the South Unit with one control structure located approximately in the center.

corrected
Water begins to pass from the North Unit to the Center Unit through the pipe arches of the emergency spillway at 1136.26 msl. Elevations of the seven, 58 inch by 36 inch pipe arches of the new emergency spillway are (from east to west) 1136.26, 1136.28, 1136.28, 1136.26, 1136.30, 1136.29, and 1136.34. Water passes from the South Unit to the Center Unit at elevation 1134.85, at which point they become contiguous. Both the South and Center Units become contiguous with the North Unit at elevation 1136.26. The elevation of the top of the stop logs on the north control structure is 1136.35.

The maximum level of 1137.25 is regulated by a control structure above the outlet siphon to the Missouri River.

B. 1964 Water Uses.

The attached Table II presents water use data for all units during 1964.

1. Owens Bay.

One, 12 inch stop log was installed in the Owens Bay control structure on October 15, 1964, when the water level was 1439.96. Presently the water level is 1440.44. This increase was necessary to provide water at the base of the Colorado ramp style duck trap to permit winter banding of waterfowl.

The breeding population of ducks on Owens Bay in 1964 was estimated at 148 pairs, compared to 183 pairs in 1963 and 80 pairs in 1962. Apparently the decline in breeding waterfowl was general in the Southern Choteau and not a reflection of the habitat, which was considered as good as in 1963.

Near optimum breeding habitat was effected in Owens Bay as the water level was lowered to 1440.11 after runoff, providing exposed shoreline and muskrat openings in the emergents.

Emergents on the east end of Owens Bay increased somewhat due to the reduction of the muskrat population this year. Aquatic production was excellent on the entire Owens Bay unit. However, by late summer floating mats of green algae covered large areas. Sago pondweed was the most abundant Potamogeton while Ceratophyllum and Elodea dominated the deeper portions of the unit. Chufa (spp.) covered most of the exposed shoreline until it was flooded in October.

The rate of flow of the artesian well was approximately 750 gallons per minute, or 1209 acre feet.

Total loss to evapo-transpiration was 979 acre feet and 230 acre feet were discharged to the South Unit during April, May, and June.

2. Lake Andes Proper.

The only water supply of Lake Andes proper is runoff and whatever is discharged as excess from Owens Bay. Inflow this year was only 536 acre feet, compared to 3115 acre feet in 1963. Little snow cover and lack of precipitation resulted in this low runoff rate. High temperatures and wind, coupled with the prolonged drought of the past year, resulted in a loss of 8195 acre feet to evapo-transpiration, an average of 1.7 feet.

Four wood stoplogs were replaced in the North Dike structure in July after vandals had used the original logs for firewood.

All units supported good stands of sago pondweed, however, over-all aquatic plant production decreased at least 75%. In 1963 aquatic plant production was so thick "a boat could not get through". This year large areas of open water persisted. Beds of hardstem bulrush and cattail increased significantly in the North Unit as water levels receded.

A die off of approximately 300 small northern pike occurred in July in Johnson Bay of the Center Unit. Bullheads were present in large numbers in all units. A contract to remove 500 tons of these fish was let to Mr. L. Kalstrom of New Town, North Dakota, by the State Department of Game, Fish and Parks. To date approximately 100 tons of fish have been removed from the South Unit. This should help aquatic production, as well as fishing, in this unit in 1965 provided the expected complete winter kill does not occur.

The breeding population of 613 pairs was lower than both 1963 and 1962 when 758 and 634 pairs were estimated. Only 76 broods were produced this year, however, in comparison with 236 and 200 broods produced in 1963 and 1962. The lack of suitable brood cover and the severe drought during the incubation period undoubtedly had an adverse affect on the production of waterfow this past year.

No botulism or other biological problems were experienced in 1964.

C. 1965 Management Program.

Owens Bay will be lowered to the 1440.12 level as soon as the danger from releasing runoff water has passed. Generally this will be in mid-March. This one foot drop will provide an exposed shoreline and muskrat openings in the emergents for waterfowl breeding territories.

The level will be raised to the 1441.12 level beginning June 15. It is anticipated that this one foot increase may take several months because the artesian well just barely replaces the evapotranspiration during the summer period. This one foot raise, after the breeding season, is designed to prevent emergents from increasing on the east end of the unit, allow enough time for the increase to reach the desired level by the fall migration, and permit use of the permanent Colorado ramp style duck trap during winter banding.

Management of Lake Andes proper depends entirely on runoff. The North Unit will be held as high as possible up to the 1436.26 level, when it begins to pass into the Center Unit. The Center and South Units will be held at the management level of 1434.85 feet. All water in excess of 1437.25 will be passed out to the Missouri River.

Peter S. Suich

Peter S. Suich
Refuge Manager

January 7, 1965

TABLE I
GENERAL IMPOUNDMENT DATA - LAKE ANDES

<u>Unit</u>	<u>Management Level</u>	<u>Area Acres</u>	<u>Capacity Acre Feet</u>	<u>Maximum Level</u>	<u>Area Acres</u>	<u>Capacity Acre Feet</u>
North	1136.26	572	2,100	1137.25	617	2,740
Center	1134.85	2,200	12,200	1137.25	2,420	17,900
South	1134.85	1,675	10,900	1137.25	1,745	14,500
Owens Bay	1141.12	232	544	1141.52	241	640
Totals		4,697	25,744		5,023	35,780

corrected

TABLE II
IMPOUNDMENT DATA - 1964

	North Unit			Center Unit		
January	1435.99	557	1,969	1435.92	2235	14,780
February	1436.00	558	1,970	1435.92	2235	14,780
March	1436.00	558	1,970	1435.94	2237	14,800
April	1436.04	559	2,020	1435.96	2240	14,820
May	1435.68	542	1,800	1435.82	2227	14,400
June	1435.62	540	1,770	1435.54	2212	13,800
July	1435.64	541	1,810	1435.48	2205	13,600
August	1435.23	520	1,520	1434.90	2175	12,400
September	1434.03	510	1,400	1434.73	2162	12,000
October	1434.75	496	1,280	1434.53	2150	11,500
November	1434.56	484	1,180	1434.27	2135	11,000
December	1434.50	482	1,160	1434.16	2125	10,800
Inflow	91 acre feet from watershed.			40 acre feet from watershed.		
Outflow	900 acre feet evapo-transpiration.			4020 acre feet evapo-transpiration.		
	South Unit			Owens Bay Unit		
January	1435.82	1710	12,600	1441.13	233	545
February	1435.92	1715	12,700	1441.13	233	545
March	1435.94	1716	12,750	1441.13	233	545
April	1435.96	1717	12,775	1441.17	235	550
May	1435.82	1710	12,600	1441.06	231	522
June	1435.54	1700	12,000	1440.22	208	340
July	1435.48	1695	11,900	1440.11	205	320
August	1434.97	1685	11,000	1440.07	203	310
September	1434.55	1670	10,400	1439.90	198	280
October	1434.36	1668	10,100	1439.98	200	290
November	1434.10	1660	9,700	1440.07	203	310
December	1434.00	1659	9,500	1440.14	215	390
Inflow	175 acre feet from watershed, 230 acre feet from Owens Bay.			750 gal. per minute, 1209 acre feet.		
Outflow	3275 acre feet evapo-transpiration.			230 acre feet discharged to South Unit, 979 acre feet evapo-transpiration.		

LAKE ANDES NATIONAL WILDLIFE REFUGE
 AREA-CAPACITY TABLE
 for
 NORTH UNIT (Unit 3)

<u>Elevation</u> <u>(msl)</u>	<u>(assumed)</u>	<u>Capacity</u> <u>Acre-Feet</u>	<u>Difference</u> <u>in Capacity</u>	<u>Area</u> <u>Acres</u>	<u>Diff. in</u> <u>Area</u>
1429.25	92	0		0	
1430.25	93	21	21	42	42
1431.25	94	106	85	128	86
1432.25	95	300	194	260	132
1433.25	96	626	326	392	132
1434.25	97	1,055	429	466	74
1435.25	98	1,548	493	520	54
1436.25	99	2,093	545	570	50
1437.25	*100	2,683	590	611	41
1438.25	101	3,312	629	647	36
1439.25	102	3,975	663	680	33

*100.0 = Original Water Right Filing elevation.

Note: Current spillway crest (North-Center Units) = 1436.35 elev.

Planimetered from Solberg's contour map by RWD 6/15/43
 retyped 2/25/64 GWS

See Dwg. SR-So.Dak.-173-6

LAKE ANDES NATIONAL WILDLIFE REFUGE
 AREA-CAPACITY TABLE
 for
 MIDDLE UNIT (Unit 2)

<u>Elevation</u>	<u>Capacity Acre-Feet</u>	<u>Difference in Capacity</u>	<u>Area Acres</u>	<u>Diff. in Area</u>
1427.0	0		195	
		550		707
1428.0	550		902	
		1,120		436
1429.0	1,670		1,338	
		1,480		282
1430.0	3,150		1,620	
		9,470		550
1435.0	12,620		2,170	
		11,900		420
1440.0	24,520		2,590	

Note: Current spillway crest (South-Center Units) = 1434.85 mal
 Data obtained from (BR) curves, Wagner Unit - Letter incl. of 5/29/62.

LAKE ANDES NATIONAL WILDLIFE REFUGE
 AREA-CAPACITY TABLE
 for
 SOUTH UNIT (Unit 1)

<u>Elevation</u>	<u>Capacity Acre-Feet</u>	<u>Difference in Capacity</u>	<u>Area Acres</u>	<u>Diff. in Area</u>
1426.0	0		0	
		835		836
1428.0	835		836	
		2,325		654
1430.0	3,160		1,490	
		7,945		198
1435.0	11,105		1,688	
		8,755		162
1440.0	19,860		1,850	

Note: Current spillway crest (South-Center Units) = 1434.85 msl

Data obtained from (BR) curves, Wagner Unit - Letter incl. of 5/29/62.

LAKE ANDES NATIONAL WILDLIFE REFUGE
AREA-CAPACITY TABLE
for
OWENS BAY UNIT

<u>Elevation</u>	<u>Capacity Acre-Feet</u>	<u>Difference in Capacity</u>	<u>Area Acres</u>	<u>Diff. in Area</u>
1436.52	0		0	
		11		22
1437.52	11		22	
		201		157
1439.52	212		179	
		421		63
1441.52	633		242	
		522		38
1443.52	1,155		*280	

* Water Right filing no. 220-3 based on 280 surface acres.

Note: Current spillway crest = 1441.52 elevation
= 96.0 (assumed) on Dwg. 3R-So.Dak.-173-2 =
6.0 on water gauge forms prior to September 1964
Planimetered from Dwg. M-So.Dak.-2.02 by RWD 4/3/58
retyped 2/25/64 CWS
Also see Dwg. 3R-So.Dak.-173-1 & 2

LAKE ANDES NATIONAL WILDLIFE REFUGE
AREA-CAPACITY TABLE
for
SOUTH UNIT (Unit 1)

<u>Elevation</u> (msl)	<u>(assumed)</u>	<u>Capacity</u> <u>Acre-Foot</u>	<u>Difference</u> <u>in Capacity</u>	<u>Area</u> <u>Acres</u>	<u>Diff. in</u> <u>Area</u>
1426.25	89	0		0	
			541		1082
1427.25	90	541		1,082	
			1,206		248
1428.25	91	1,747		1,330	
			1,395		130
1429.25	92	3,142		1,460	
			1,492		65
1430.25	93	4,634		1,525	
			1,547		45
1431.25	94	6,181		1,570	
			1,587		35
1432.25	95	7,768		1,605	
			1,621		33
1433.25	96	9,389		1,638	
			1,649		22
1434.25	*97	11,038		1,660	
			1,673		27
1435.25	98	12,711		1,687	
			1,704		35
1436.25	99	14,415		1,722	
			1,744		45
1437.25	100	16,159		1,767	
			1,789		45
1438.25	101	17,948		1,812	
			1,831		39
1439.25	102	19,779		1,851	

*97.0 = Original water right filing elevation.

Note: Current spillway crest (South-Center Units) = 1434.85 elev.

Planimetered from Solberg's contour map by RWD 6/15/45
retyped 2/25/64 GWS

See Dwg. SR-So.Dak.-173-4 & 173-5



BUREAU OF SPORT FISHERIES AND WILDLIFE
INTER-OFFICE TRANSMITTAL

APR 18 1965

REG. DIR.	REG. DIR.
INFO. OFF.	INFO. OFF.
ADMIN. OFF.	ADMIN. OFF.
PROP. MAT.	PROP. MAT.
ACTION	ACTION
PERS. ST.	PERS. ST.
CHIEF DIV.	CHIEF DIV.
INFORMATION	INFORMATION

- Director, _____
- Regional Director, _____
- Project Leader, _____
- Supervisor, Branch of Wildlife Refuges _____

From _____ Office
 Refuge Manager Lake Andes Refuge

Subject Water Management Plan

Attached is the revised Water Management Plan.
 Also attached is a map showing the location of the gauges installed by refuge personnel.

Peter S. Suich
 Peter S. Suich

*File Lake Andes Water
mgp
plan* 1.

JK

LAKE ANDES NATIONAL WILDLIFE REFUGE
Lake Andes, South Dakota

WATER MANAGEMENT PLAN

Revised
January, 1965

A. History.

Lake Andes is a natural prairie lake of about 4800 acres. The run-off from an 84,800 acre watershed and one artesian well supply the water. No permanent streams empty into the lake. The water supply is entirely dependent upon precipitation, except for the flow from the artesian well at Owens Bay.

The lake has alternated between full and dry since records have been maintained. In 1878, three years after this area was surveyed, the lake was dry. It was at a record high in 1882. It was dry again in 1894.

Artesian wells were dug in 1898 and about 1900 to supply water for Indian cattle.

The lake was full from 1894 to 1924. In 1921, high water damaged adjacent farm lands.

A concrete tube was installed in 1934, a year of low water levels. This tube, located in the southwest end of the lake, provides the only outlet. It is one and one-fourth miles long.

Two dikes, dividing the lake into three units, were constructed in 1938 and 1939 during low and/or dry water conditions.

The lake gradually filled during the 1940's and spilled out the overflow in 1951. The lake was dry again in 1958 and 1959. It refilled in 1961 and 1962. Water flowed out the outlet tube to the Missouri River from June 16 until November 5, 1962. On April 13, 1963, water again rose to the top of the outlet structure, elevation 1437.25 msl. Below average precipitation and a high evapo-transpiration rate reduced levels to below management level on all units by August, 1964.

There have been at least seven artesian wells drilled around the lake. The first two, at Rest Haven Resort, flowed for 50 years. Of the three wells drilled on refuge property around Owens Bay, only one is still flowing. This well was drilled in 1957.

Lake Andes is an extremely productive lake for fish and waterfowl when water supplies are adequate. Fall migration peaks of 1,500,000 ducks and 40,000 Canada geese have been recorded in the Fort

Randall-Lake Andes complex. Wintering populations of up to 300,000 mallards and 14,000 Canada geese move to the open water of Owens Bay when the reservoir completely freezes, usually during January of each year.

The lake is an important migrational rest stop, attracting large flights of waterfowl. During fall migration, many red heads, canvasbacks, scaup, and ring-neck ducks are attracted.

The objective of Lake Andes Refuge is threefold. The primary objective is to provide the wintering mallards and Canada geese with an adequate food supply to sustain them during periods of severe weather; secondly, to provide a migrational rest stop; and thirdly, to provide suitable and adequate habitat for nesting waterfowl. A fourth objective is recreation.

Requirements for these objectives can be met by producing adequate and appropriate aquatic vegetation and grain crops, maintaining open water during the winter, and maintaining an adequate depth of water to sustain the fish population.

There has been much public demand in the past to stabilize water levels for recreational use since the lake has become famous for its good fishing. Artesian wells, diverting water from other drainage areas, and pumping water from the Fort Randall Reservoir have been studied and rejected. The latest proposal is a Bureau of Reclamation and Corps of Engineer irrigation project. An irrigation district, including Charles Mix and Brule Counties, would use the Center Unit as a reservoir with a portion of the irrigation runoff being diverted to the North Unit.

Botulism was reported once in 1949 when water levels were at an average height. Lead poisoning has accounted for 100 to 200 mallards per year in the wintering flock. The excellent shooting provided over the years has lead to a high concentration of shot on the bottom of the lake, especially in Owens Bay.

B. Water Rights.

Lake Andes is a meandered lake. In 1939 the South Dakota Department of Game, Fish and Parks conveyed a perpetual easement to the Bureau of Biological Survey to the original meander elevation of 1433.25 msl. A flowage easement to 1437.25 msl was established by a Congressional Act in 1922, which also established the high water mark at 1437.25 msl. The flowage easements obtained from the private property owners along the shoreline were never recorded.

The following water rights now exist:

1. North Unit.

- a. Water filing number U.S. 517-3 for 611 surface acres at elevation 1437.25 msl and for 2683 acre feet storage and 1833 acre feet seasonal use. Priority date - April 22, 1940.
 - b. Flowage easement to elevation 1437.25 msl by virtue of Congressional Act in 1922.
2. Center Unit.
- a. No water right filing.
 - b. Flowage easement to elevation 1437.25 msl by virtue of 1922 Congressional Act.
3. South Unit.
- a. Water right filing number 517-3 for 1660 surface acres at elevation 1434.25 msl and for 11,038 acre feet storage, and 4980 acre feet seasonal use. Priority date - April 22, 1940.
 - b. Water right filing for a maximum amount of 100 cfs from the western diversion ditch at a point located in Sec. 5, T.96N., R.65W., from January to December each year.
 - c. Flowage easement to elevation 1437.25 msl by virtue of 1922 Congressional Act.
4. Owens Bay.
- a. Water right filing number 220-3 for an annual use of 2.22 cfs (1000 gpm) from an artesian well for a 280 acre surface area. Priority date - July 6, 1956.
 - b. Fee title ownership of 775 acres including and surrounding Owens Bay in Sections 5 and 6, T.96N., R.64W.

The Service also has title to 80 acres, 18 of which are upland, in Sec. 9, T.97N., R.64W., and 23 acres of land for the diversion ditch in Sec. 5, T.96N., R.65W.

An emergency spillway and channel were constructed by the Service on the west end of the North Dike in 1964. Water will start to flow through the tubes from the North Unit to the Center Unit at 1436.26 feet.

C. Water Supply.

1. Precipitation.

The total water storage of Lake Andes proper at management levels is 25,200 acre feet, and that of Owens Bay is 544 acre feet.

The contributing watershed is estimated at 84,800 acres. The 1958 Soil Conservation Service reconnaissance survey estimated the following frequency of runoff:

<u>Frequency of Occurrence</u>	<u>Runoff</u>
80% chance (1 in 1.25 years)	1,260 acre feet
50% chance (1 in 2 years)	3,300 acre feet
20% chance (1 in 5 years)	9,600 acre feet
10% chance (1 in 10 years)	16,500 acre feet

Assuming the Lake is dry, a 10 year frequency rain is needed to fill the lake. The SCS report states that there is not sufficient precipitation and runoff to support fish in all three units of the lake. However, reports indicate that Lake Andes supported fish when water was present. These periods ranged from 16 to 45 years in length.

2. Artesian Wells.

Only one well out of at least seven is now functioning. This well was drilled in 1957 on Owens Bay at a cost of \$30,000. The casing and screen are of a noncorrosive material, which is necessary to prevent the casing from corroding through and collapsing. Immediately after completion, the well flowed at the rate of 1,000 gallons per minute. At the end of 1964, it was flowing at approximately 750 gallons per minute, or 1209 acre feet per year.

The artesian head in the Lake Andes area has dropped 68 feet in the past 50 years, according to the Geological Survey, with a head of 90 feet still present in 1957. At this rate of decline, artesian wells in the area should cease to flow in about 60 years.

However, the rate of flow from the artesian well at Owens Bay has declined from 1000 gpm to 750 gpm in the last 7 years. If this rate of decrease continues, the well will cease to flow in 15 years, or approximately 1980.

Although the State Water Resources Board may approve the replacement of artesian wells, this source of water should be limited to domestic purposes. The cost of the large number of wells required, as well as the decrease in an adequate water supply, prohibits the use of artesian wells to maintain a stable water supply in the lake.

3. Additional Drainage.

- a. The diversion ditch west of Lake Andes was constructed to divert water from Garden Creek to Lake Andes. This ditch was plugged in 1955 when tort claims resulted from the flooding of private lands. There is a possibility of replacing the plug with a culvert and rebuilding the embankment to prevent flood damage. Contour maps indicate this watershed would contain 3200 acres, which would provide an additional 100 acre feet of water per year.
- b. A 2000 acre watershed south of Lake Andes, which is steep and hilly, could provide 70 acre feet of water per year. The diversion could be constructed along the old railroad grade built during construction of the Fort Randall Dam.
- c. A third area of 16,000 acres in the Corsica district northeast of Lake Andes could be diverted into Andes Creek, which drains into the North Unit. However, good pothole habitat for waterfowl would be destroyed.
- d. Pumping water from the Fort Randall Reservoir cannot be justified for wildlife and recreational benefits. An estimate in 1952 for the cost of pumps and canal was \$430,000, with an annual maintenance cost of \$16,000. Current costs would be somewhat higher.
- e. The Wagner Irrigation Unit proposal would use the South and Center Units to hold water for the irrigation of lands to the east and south of Lake Andes. The South Unit would be used for recreational purposes. The North Unit would not be affected by this irrigation proposal and both the Center and North Units would be managed for waterfowl. Excess irrigation water would be diverted into the North Unit.

Landowners are presently on record as opposed to this Bureau's wildlife development of the Choteau Creek area included in this proposal.

Considering these five possibilities of obtaining additional water, precipitation is the only practical source of water at the present time. The lake naturally fluctuates between high and low water levels and this may relate to the high fertility and excellent aquatic plant production. A stable water level is less desirable for waterfowl production habitat. Manipulation of water levels is necessary to produce quality waterfowl habitat.

D. Other Management Considerations.

No carp are present in Lake Andes. A fish barrier was constructed below the outlet tube in 1964. This should eliminate the problem of trash fish entering the lake as in the past.

Presently the South Dakota Department of Game, Fish and Parks has a contract in effect for the removal of approximately one million pounds of bullheads. This should improve fishing in general, as well as improve the aquatic plant production.

A conflict exists between local demand for high water levels for fishing and boating and minimum levels for desirable waterfowl production habitat and aquatic food plants.

The past and present practice is to maintain water levels as high as possible in the North and South Units, as they receive the greatest amount of runoff. The Center Unit is filled when the other units reach their maximum management levels. This method decreases evaporation loss from the three separate units and insures the most water possible through drought periods.

Owens Bay water levels can be manipulated by a stop log control at the spillway. The artesian well supplies adequate water to maintain desired levels.

The refuge has acquired additional acreage for farming during recent years. Approximately 350 acres of corn and milo are grown for the wintering flock of mallards and Canada geese to prevent starvation during periods of severe weather and depredations on adjoining farm lands. The artesian well provides open water during the winter for the large concentrations of waterfowl. The water and marsh area is small, a total of 280 acres. The value of this area as a wintering and migrational rest stop far outweighs its maximum potential value as a production area. Therefore, the primary management objectives of Owens Bay should be as a wintering area, a migrational rest stop, and a production area, in that order.

With these objectives in mind, it is recommended that:

The water levels fluctuate no more than one foot between 1440.12 and 1441.12 feet. Following spring runoff, usually mid-March, the level should be dropped to 1440.12 to provide breeding territories for waterfowl. After the nesting season, about June 15, the level should be raised to 1441.12. This fluctuation will tend to eliminate the heavy emergent growth along the shoreline, especially river bulrush which is encouraged by low water levels. Water levels lower than 1440.12 reduce the amount of open water necessary for the wintering waterfowl population.

Water levels higher than 1441.12 "soften" the county road bed

on the east and curtail complete shoreline grazing of Owens Bay.

In 1957 Owens Bay was dry. The pool bottom was well aerated and in good condition for pondweed production at that time. In 1964 pondweed production was good.

A complete drawdown will be effected every 10 years. If aquatic plant production, especially sago pondweed, begins to deteriorate, it may be necessary to draw the pool down as frequently as every 5 years. Careful aquatic plant observations and records will be maintained to determine if complete and/or more frequent drawdowns are required.

Complete drawdowns will be made from June 20 to September 15. This period should be sufficient to provide bottom aeration and stimulate plant production.

The pool should then be refilled as quickly as possible to provide as much water as possible for the fall migrants and wintering waterfowl.

Proposed Pool Levels for Owens Bay

<u>Year</u>	<u>Mid-March</u>	<u>June 15</u>
1965	1440.12	1441.12
1966	do	do
1967	Drawdown from June 20 to September 15 then refill as quickly as possible.	
1968	1440.12	1441.12
1969	do	do
1970	do	do
1971	do	do
1972	do	do
1973	do	do
1974	do	do
1975	do	do
1976	do	do
1977	Drawdown from June 20 to September 15 then refill as quickly as possible.	

E. Recommendations.

The water management objective at Lake Andes is to hold as much water as possible to carry it through drought periods. The North and South Units receive most of the runoff water and will normally be filled first.

Seven, 58 inch by 38 inch pipe arches and spillway channel were constructed in 1964 on the west end of the North Dike. The flow

line of the lowest pipe arch is 1136.26 msl, at which point water will flow from the North Unit to the Center Unit. This is .09 foot lower than the crest of the north dike control structure.

The crest of the south unit control structure is 1134.85 msl.

All units are equal at 1137.25, the elevation when water will pass from the outlet tube at the south end of the South Unit.

The possibility of carp entering the lake via the outlet tube has been reduced by the construction of the fish barrier.

Periodic checks should still be made of the farm ponds in the watershed and the fish barrier during flood waters to insure that no trash fish enter the lake.

If and when the Wagner Irrigation proposal becomes a reality, this plan will need extensive revision as modified and/or additional control structures will be necessary to manipulate water levels and provide for periodic drawdowns.

Peter S. Suich

Peter S. Suich
Refuge Manager

April 7, 1965

Regional Supervisor
Branch of Wildlife Refuges

February 16, 1965

Regional Engineer

EM-R Lake Andes
Water Mgmt. Plan

Lake Andes NWR, South Dakota - 1965 Annual Water Management Plan

We have reviewed the subject plan and concur in the proposed 1965 operation which includes a revision on Owens Bay from last year.

We note that the refuge manager is now utilizing the revised area capacity data sent to him last year, and we have only a minor comment to make in this regard. Table I of the 1965 water management plan should be corrected to read 17,900 acre-feet capacity at elevation 1437.25 for the Center Unit.

As a follow-up to the area-capacity curves submitted the refuge manager in February 1964, we are now attaching the same information in tabular form which should be easier to use. The five attached tabulations contain reference notes which should be quite helpful to the manager also. Two tabulations prepared for the South Unit (sheets 3 and 5) reflect the capacity change in this unit from the time of the first survey. The most recent area-capacity data (sheet 3) is already being used by the refuge manager.

With regard to the revised water management plan, section B, "Water Rights":

We are attaching a copy of a letter to Mr. M. L. Baker, dated February 17, 1961, which summarizes a bit of the history at Lake Andes. We wish to call to your attention the following apparent corrections to page 4 of the refuge manager's narrative regarding water right:

1. The permanent high water mark was established at Lake Andes in 1922 by a Congressional bill and is at elevation 1437.25 msl. We have no apparent right to operate the three main Lake Andes units above this level.
2. The perpetual easement granted by the South Dakota Department of Game, Fish and Parks in 1939 is apparently only to the original meander elevation or 1433.25 msl.
3. We find no evidence that flowage easements acquired from private land owners (1939 to 1940) were ever recorded. These easements were intended to allow the U. S. Government to flood the units up to a four foot level above elevation 1433.25 msl.

Stephan
2-16-65

Doering
2-16-65

Slinson
2/16/65

Wright
2/16/65

Umberg
2-16

Jensen
2-17

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2-18

FILED
RECORDED
2-20-65
2-17-65
C.C.S.

In summary, we do have the following rights on Lake Andes:

North Unit (a) Water right filing no. U.S. 517-3 for 611 surface acres at elevation 100 assumed (1437.25 msl) and for 2683 acre-feet storage and 1833 acre-feet seasonal use. Priority date - April 22, 1940.

(b) Flowage easement to elevation 1437.25 msl by virtue of Congressional Act in 1922.

Middle Unit (a) No water right filing

(b) Flowage easement to elevation 1437.25 msl by virtue of 1922 Congressional Act.

South Unit (a) Water right filing no. 517-3 for 1660 surface acres at elevation 97 assumed (1434.25 msl) and for 11,038 acre-feet storage, and 4980 acre-feet seasonal use. Priority date - April 22, 1940.

(b) Water right filing for a maximum amount of 100 cfs from the western diversion ditch at a point located in Sec. 5, T.96N., R.65W., from January to December each year. (The actual amount available from a 2560 acre watershed is some 100+ acre-feet annually as stated by the refuge manager on page 6 of his revised management plan.

(c) Flowage easement to elevation 1437.25 msl by virtue of 1922 Congressional Act.

Owens Bay (a) Water right filing no. 220-3 for an annual use of 2.22 cfs (1000 gpm) from an artesian well for a 280 acre surface area. Priority date-July 6, 1956.

(b) Fee title ownership of 775 acres including and surrounding Owens Bay.

You will note that on the area-capacity table for Owens Bay (sheet 4 of 5) the 280 acre surface area corresponds to elevation 98 (assumed) or 1443.52 msl. We arrived at this correlation using the contours from Drawing No. 3R-So.Dak.-179.2 and April 22, 1953, survey data. This 1953 survey related assumed datum to mean sea level elevations at Owens Bay.

Although our water right on Owens Bay provides that water be applied on a 280 surface acres it appears that this is not desirable because it causes an adverse effect on the county seed bed on the east end of Owens Bay at the corresponding elevation of 1443.52 msl.

Just as a minor note, the emergency spillway construction in the North Dike consists of seven 50" x 36" pipe arches. The term "5-foot culverts" is somewhat misleading in this respect.

We are pleased to see that the refuge manager has computed inflow and outflow to each unit and to Owens Bay. Although the method used is not given, we checked his figures fairly close using his estimated inflow data. We might suggest that the manager give an example of the method or formula used in figuring future inflow-outflow data so that we can check and verify his figures.

We still desire a map or sketch showing the actual location of existing water gauges on the refuge as requested in your request memorandum dated December 9, 1964.

John D. Umberger

Attachments

2 extra cc attd.

CWStephan:rj 2/16/65

LAKE ANDES NATIONAL WILDLIFE REFUGE
Lake Andes, South Dakota

ANNUAL WATER MANAGEMENT PLAN - 1965

A. Existing Water Supply.

Unit	Gauge Reading*	Management Level	Maximum Level	Inflow (Approx.)	Outflow (Approx.)
North	1434.50	1436.26	1437.25	None	None
Center	1434.16	1434.85	1437.25	None	None
South	1434.00	1434.85	1437.25	None	None
Owens Bay	1440.44	1441.12	1441.52	750 g.p.m.	None

Staff gauges have been installed on all units. Direct mean sea level readings are now in effect.

* Last three digits indicate actual gauge reading.

Lake Andes proper is divided into three units by two dikes. The North Dike, which separates the North Unit from the Center Unit, has a control structure on the east end and a newly constructed emergency spillway and channel on the west end. The South Dike separates the Center Unit from the South Unit with one control structure located approximately in the center.

58" x 36"
PIPE ARCH

Water begins to pass from the North Unit to the Center Unit through the culverts of the emergency spillway at 1436.26, m.s.l. Elevations of the seven, 8-foot culverts of the new emergency spillway are (from east to west) 1436.26, 1436.28, 1436.28, 1436.26, 1436.30, 1436.29, and 1436.34. Water passes from the South Unit to the Center Unit at elevation 1434.85, at which point they become contiguous. Both the South and Center Units become contiguous with the North Unit at elevation 1436.26. The elevation of the top of the stop logs on the north control structure is 1436.35.

DESIGN INI
ELEV. =
1436.4

The maximum level of 1437.25 is regulated by a control structure on the outlet siphon to the Missouri River.

PREPARED - 19.03
1964

B. 1964 Water Uses.

The attached Table II presents water use data for all units during 1964.

1. Owens Bay.

One 12 inch stop log was installed in the Owens Bay control structure on October 15, 1964, when the water level was

1439.96. Presently the water level is 1440.44. This increase was necessary to provide water at the base of the Colorado ramp style duck trap to permit winter banding of waterfowl.

The breeding population of ducks on Owens Bay in 1964 was estimated at 148 pairs, compared to 183 pairs in 1963 and 80 pairs in 1962. Apparently the decline in breeding waterfowl was general in the Southern Choteau and not a reflection of the habitat, which was considered as good as in 1963.

Near optimum breeding habitat was effected in Owens Bay as the water level was lowered to 1440.11 after runoff, providing exposed shoreline and muskrat openings in the emergents.

Emergents on the east end of Owens Bay increased somewhat due to the reduction of the muskrat population this year. Aquatic production was excellent on the entire Owens Bay unit. However, by late summer floating mats of green algae covered large areas. Sago pondweed was the most abundant Potamogeton while Ceratophyllum and Eloдея dominated the deeper portions of the unit. Chufa (spp.) covered most of the exposed shoreline until it was flooded in October.

The rate of flow of the artesian well was approximately 750 gallons per minute; or 1209 acre feet.

2. Lake Andes Proper.

The only water supply of Lake Andes proper is runoff and whatever is discharged as excess from Owens Bay. Inflow this year was only 516 acre feet, compared to 3115 acre feet in 1963. Little snow cover and lack of precipitation resulted in this low runoff rate. High temperatures and wind, coupled with the prolonged drought of the past year, resulted in a loss of 8386 acre feet to evapo-transpiration. All units decreased an average of 1.7 feet. Four wood stoplogs were replaced in the North Dike structure in July after vandals had used the original logs for firewood.

All units supported good stands of sago pondweed, however, over-all aquatic plant production decreased at least 75%. In 1963 aquatic plant production was so thick "a boat could not get through". This year large areas of open water persisted. Beds of hardstem bulrush and cattail increased significantly in the North Unit as water levels receded.

A die off of approximately 300 small northern pike occurred in July in Johnson Bay of the Center Unit. Bullheads were present in large numbers in all units. A contract to remove 500 tons of these fish was let to Mr. L. Kalstrom of New Town, North Dakota, by the State Department of Game, Fish and Parks. To

date 90 tons of fish have been removed from the South Unit. This should help aquatic production, as well as fishing, in this unit in 1965.

The breeding population of 613 pairs was lower than both 1963 and 1962 when 758 and 634 pairs were estimated. Only 76 broods were produced this year, however, in comparison with 236 and 200 broods produced in 1963 and 1962. The lack of suitable brood cover and the severe drought during the incubation period undoubtedly had an adverse affect on the production of waterfowl this past year.

No botulism or other biological problems were experienced in 1964.

C. 1965 Management Program.

Owens Bay will be lowered to the 1440.12 level as soon as the danger from releasing runoff water has passed. Generally, this will be in mid-March. This one foot drop will provide an exposed shoreline and muskrat openings in the emergents for waterfowl breeding territories.

The level will be raised to the 1441.12 level beginning June 15. It is anticipated that this one foot increase may take several months because the artesian well just barely replaces the evapotranspiration during the summer period. This one foot raise, after the breeding season, is designed to prevent emergents from increasing on the east end of the unit, allow enough time for the increase to reach the desired level by the fall migration, and permit use of the permanent Colorado ramp style duck trap during winter banding.

Management of Lake Andes proper depends entirely on runoff. The North Unit will be held as high as possible up to the 1436.26 level, when it begins to pass into the Center Unit. The Center and South Units will be held at the management level of 1434.85 feet. All water in excess of 1437.25 will be passed out to the Missouri River.

Peter S. Suich
Peter S. Suich
Refuge Manager

January 7, 1965

TABLE I

GENERAL IMPOUNDMENT DATA - LAKE ANDES

Unit	Management Level	Area Acres	Capacity Acre Feet	Maximum Level	Area Acres	Capacity Acre Feet
North	1136.26	572	2,100	1137.25	617	2,740
Center	1134.85	2,200	12,200	1137.25	2,420	16,400 17,900
South	1134.85	1,675	10,900	1137.25	1,722 ⁷⁵	11,500
Owens Bay	1141.12	232	544	1141.52	241	640
Totals		4,697	25,744		5,000	34,280

TABLE II
IMPOUNDMENT DATA - 1964

	North Unit			Center Unit		
	Gauge Reading	Surface Acres	Capacity Acre Feet	Gauge Reading	Surface Acres	Capacity Acre Feet
January	1435.99	557	1,969	1435.92	2235	14,780
February	1436.00	558	1,970	1435.92	2235	14,780
March	1436.00	558	1,970	1435.94	2237	14,800
April	1436.04	559	2,020	1435.96	2240	14,820
May	1435.68	542	1,800	1435.82	2227	14,400
June	1435.62	540	1,770	1435.54	2212	13,800
July	1435.64	541	1,810	1435.48	2205	13,600
August	1435.23	520	1,520	1434.90	2175	12,400
September	1434.03	510	1,400	1434.73	2162	12,000
October	1434.75	496	1,280	1434.53	2150	11,500
November	1434.56	484	1,180	1434.27	2135	11,000
December	1434.50	482	1,160*	1434.16	2125	10,800*
Inflow	* 91 acre feet from watershed.			* 40 acre feet from watershed.		
Outflow	991 acre feet evapo-transpiration.			4020 acre feet evapo-transpiration.		
As Dec = 1.49' = 809 AF				As Dec = 1.76' = 3930 AF		
	South Unit			Owens Bay Unit		
January	1435.82	1710	12,600	1441.13	233	545
February	1435.92	1715	12,700	1441.13	233	545
March	1435.94	1716	12,750	1441.13	233	545
April	1435.96	1717	12,775	1441.17	235	550
May	1435.82	1710	12,600	1441.06	231	522
June	1435.54	1700	12,000	1440.22	208	340
July	1435.48	1695	11,900	1440.11	205	320
August	1434.97	1685	11,000	1440.07	203	310
September	1434.55	1670	10,400	1439.90	198	280
October	1434.36	1668	10,100	1439.98	200	290
November	1434.10	1660	9,700	1440.07	203	310
December	1434.00	1659	9,500*	1440.44	215	390*
Inflow	* 385 acre feet from watershed & Owens Bay.			* 750 gal. per minute, / 1209 acre feet.		
Outflow	3375 acre feet evapo-transpiration.			210 acre feet discharged to South Unit, 999 acre feet evapo-transpiration.		
As Dec = 1.82' = 3100 AF				As Dec = 1.69' = 1550 AF		

X Summed Total Inflow (-) Outflow - Evap + Precip = ΔS
 (1) North Unit = 81' - 1.6 (520) - 0 = 774' = 809 AF
 (2) Center Unit = 40' - 1.6 (2200) - 0 = 340' = 3930 AF
 (3) South Unit = 385' - 1.6 (1670) - 0 = 225' = 3100 AF
 (4) Owens Bay = 1209' - 1.6 (220) - 210' = 647' = 1550 AF

Ave Evaporation = 33"
 1964 Precip = 19"
 19" = 1.58' net ET loss.

LAKE ANDES NATIONAL WILDLIFE REFUGE
Lake Andes, South Dakota

WATER MANAGEMENT PLAN

Revised
January, 1965

A. History.

Lake Andes is a natural prairie lake of about 4800 acres. The runoff from an 84,800 acre watershed and one artesian well supply the water. No permanent streams empty into the lake. The water supply is entirely dependent upon precipitation, except for the artesian well at Owens Bay.

The lake has alternated between full and dry since records have been kept. In 1878, three years after this area was surveyed, the lake was dry. It was at a record high in 1882. It was dry again in 1894.

Artesian wells were dug in 1898 and about 1900 to supply water for Indian cattle.

The lake was full from 1894 to 1924. In 1921, high water damaged adjacent farm lands.

A concrete tube was installed in 1934, a year of low water levels. This tube, located in the southwest end of the lake, provides the only outlet. It is one and one-fourth miles long.

Two dikes, dividing the lake into three units, were built in 1938 and 1939, during low and/or dry water conditions.

The lake gradually filled during the 1940's and spilled out the

1941-1942
See
property
records

overflow in 1951. The lake was dry again in 1958 and 1959. It refilled in 1961 and 1962. Water flowed out the outlet tube to the Missouri River from June 16 until November 5, 1962. On April 13, 1963, water again rose to the top of the outlet structure, elevation 1437.25, m.s.l. Below average precipitation and a high evapo-transpiration rate reduced levels to below management level on all units by August, 1964.

There have been at least seven artesian wells drilled around the lake. The first two, at Rest Haven Resort, flowed for 50 years. Of the three wells drilled on refuge property around Owens Bay, || only one is still flowing. This well was drilled in 1957.

Lake Andes is an extremely productive lake for fish and waterfowl when water supplies are adequate. Fall migration peaks of 1,500,000 ducks and 40,000 Canada geese have been recorded in the Fort Randall-Lake Andes complex. Wintering populations of up to 185,000 mallards and 12,000 Canada geese move to the open water of Owens Bay when the reservoir completely freezes, usually during January of each year.

The lake is an important migrational rest stop, attracting large flights of waterfowl. During fall migration, many red heads, canvasbacks, scaup, and ring-neck ducks are attracted.

The objective of Lake Andes Refuge is threefold. The primary objective is to provide the wintering mallards and Canada geese with an adequate food supply to sustain them during periods of severe

weather; secondly, to provide a migrational rest stop; and thirdly, to provide suitable and adequate habitat for nesting waterfowl. A fourth objective is recreation.

Requirements for these objectives can be met by production of adequate and appropriate aquatic vegetation and grain crops, maintaining open water during the winter, and an adequate depth of water to sustain the fish population.

There has been much public demand in the past for stable water levels for recreational use since the lake has become famous for its good fishing. Artesian wells, diverting water from other drainage areas, and pumping from Fort Randall Reservoir have been studied and rejected. The latest proposal is a Bureau of Reclamation and Corps of Engineer irrigation project. An irrigation district, including Charles Mix and Brule Counties, would use the Center Unit as a reservoir with a portion of the irrigation runoff being diverted to the North Unit.

Botulism was reported once in 1949 when water levels were at an average height. Lead poisoning has accounted for 100 to 200 mallards per year in the wintering flock. The excellent shooting provided over the years has probably lead to a high concentration of shot on the bottom of the lake, and especially in Owens Bay.

B. Water Rights.

Lake Andes is a meandered lake. The State of South Dakota conveyed a perpetual easement to the Bureau of Biological Survey to the water

To 1439.25
OR to 2'
above the ordinary
HWM or Max. W.S.
established by 1922
Act.
C. Stephens
9-71

rights of Lake Andes in 1939. Easements up to two feet above the high water line; or 1439.35² feet, were also obtained from private property owners of the shoreline.

The Service has complete ownership of approximately 775 acres in Sections 5 and 6, T96N, R64W; and 80 acres, 18 of which are upland, in Section 9, T97N, R64W. The Service also has title to 23 acres of land for the diversion ditch in Section 5, T96N, R65W.

An emergency spillway and channel were constructed by the Service on the west end of the North Dike in 1964. Water will start to flow through the tubes from the North Unit to the Center Unit at 1436.26 feet.

There are no parties with prior water rights on Lake Andes.

C. Water Supply.

1. Precipitation.

To Management levels

The total water storage of Lake Andes is 25,200 acre feet.

Water storage of Owens Bay is 554 feet. (See table 1)

The contributing watershed is estimated at 84,800 acres. The 1958 Soil Conservation Service reconnaissance survey estimated the following frequency of runoff:

<u>Frequency of Occurrence</u>	<u>Runoff</u>
80% chance (1 in 1.25 years)	1,260 acre feet
50% chance (1 in 2 years)	3,300 acre feet
20% chance (1 in 5 years)	9,600 acre feet
10% chance (1 in 10 years)	16,500 acre feet

Assuming the lake is dry, a 10 year frequency rain is needed

to fill the lake. The SCS report states that there is not sufficient precipitation and runoff to support fish in all three units of the lake. However, reports indicate that Lake Andes supported fish when water was present. These periods ranged from 16 to 45 years in length.

2. Artesian Wells.

Only one well out of at least seven is now functioning. This well was drilled in 1957 on Owens Bay at a cost of \$30,000. The casing and screen are of a noncorrosive material, which is necessary to prevent the casing from corroding through and collapsing. Immediately after completion, the well flowed at the rate of 1,000 gallons per minute. At the end of 1964, it was flowing at approximately 750 gallons per minute, or 1209 acre feet per year.

The artesian head in the Lake Andes area has dropped 68 feet in the past 50 years, according to the Geological Survey, with a head of 90 feet still present in 1957. At this rate of decline, artesian wells in the area should cease to flow in about 60 years.

57
20
8017

However, the rate of flow from the artesian well at Owens Bay has declined from 1000 g.p.m. to 750 g.p.m. in the last 7 years. At this rate, it will cease to flow in 15 years, or approximately 1980.

Although the State Water Resources Board may approve the

51
64

*This is not true!!
7/9/57 flow
has been 750 g.p.m. due
to gravel packing
done
2/8/57
EWR file
aws
3-10-69*

replacement of artesian wells, this source of water should be limited to domestic purposes. The cost of the large number of wells required, as well as the decrease in an adequate water supply, prohibits the use of artesian wells to maintain a stable water supply in the lake.

3. Additional Drainage.

- (a) The diversion ditch west of Lake Andes was constructed to divert water from Garden Creek to Lake Andes. This ditch was plugged in 1955 when tort claims resulted from the flooding of private lands. There is a possibility of replacing the plug with a culvert and rebuilding the embankment to prevent flood damage. This 2560 acre watershed ^{3200 ft. wide, 1/2 mi. long} would provide an additional 100 acre feet of water per year. ^{OK}
- (b) A 2000 acre watershed south of Lake Andes, which is steep and hilly, could provide 70 acre feet of water per year. The diversion could be constructed along the old railroad grade built during construction of the Fort Randall Dam.
- (c) A third area of 16,000 acres in the Corsica district northeast of Lake Andes could be diverted into Andes Creek, which drains into the North Unit. However, good pothole habitat for waterfowl would be destroyed.
- (d) Pumping water from the Fort Randall Reservoir cannot be justified for wildlife and recreational benefits. An

estimate in 1952 for the cost of pumps and canal was \$430,000, with an annual maintenance cost of \$16,000. Current costs would be somewhat higher.

- (e) The Wagner Irrigation Unit proposal would use the South and Center Units to hold water for the irrigation of lands to the east and south of Lake Andes. The South Unit would be used for recreational purposes. The North Unit would not be affected by this irrigation proposal and both the Center and North Units would be managed for waterfowl. Excess irrigation water would be diverted into the North Unit.

Presently, landowners are on record as opposed to this Bureau's wildlife development of the Choteau Creek area included in this proposal.

Considering these five possibilities of obtaining additional water, precipitation is the only practical source of water at the present time. The lake naturally fluctuates between high and low water levels and this may relate to the high fertility and excellent aquatic plant production. A stable water level is less desirable for waterfowl production habitat. Manipulation of water levels is necessary to produce quality waterfowl habitat.

D. Other Management Considerations.

At present, no carp are present in Lake Andes. A fish barrier was

— installed below the outlet tube in 1964. This should eliminate the problem of trash fish entering the lake as in the past.

Presently the State Department of Game, Fish and Parks has a contract in effect for the removal of approximately one million pounds of bullheads. This should improve fishing in general, as well as improve the aquatic plant production.

A conflict exists between local demand for high water levels for fishing and boating and minimum levels for desirable waterfowl production habitat and aquatic food plants.

The past and present practice is to maintain water levels as high as possible in the North and South Units, as they receive the greatest amount of runoff. The Center Unit is filled when the North and/or South Units reach their maximum management levels. This method decreases evaporation loss from the three separate units and insures the most water possible through drought periods.

Owens Bay water levels can be manipulated by a stop log control at the spillway. The artesian well supplies adequate water to maintain desired levels.

The Refuge has acquired additional acreage for farming during recent years. Approximately 350 acres of corn and milo are grown for the wintering flock of mallards and Canada geese to prevent starvation during periods of severe weather and depredations on adjoining farm lands. The artesian well provides open water during the winter for

the large concentrations of waterfowl. The water area is small, a total of 280 acres. The value of this area as a wintering and migrational rest stop far outweighs its maximum potential value as a production area. Therefore, the primary management objectives of Owens Bay should be as a wintering area, a migrational rest stop, and a production area, in that order.

With these objectives in mind, it is recommended that:

The water levels fluctuate no more than one foot between 1440.12 and 1441.12 feet. Following spring runoff, usually mid-March, the level should be dropped to 1440.12 to provide breeding territories for waterfowl. After the nesting season, about June 15, the level should be raised to 1441.12. This fluctuation will tend to eliminate the heavy emergent growth along the shoreline, especially river bulrush which is encouraged by low water levels. Water levels lower than 1440.12 reduce the amount of open water necessary for the wintering waterfowl population.

Water levels higher than 1441.12 "soften" the county road bed on the east and curtail complete shoreline grazing of Owens Bay. //

In 1957 Owens Bay was dry. The pool bottom was well aerated and in good condition for pondweed production at that time. In 1964 pondweed production was good. /

A complete drawdown will be effected every 10 years. If aquatic plant production, especially sago pondweed, begins to deteriorate, it may be necessary to draw the pool down more frequently. Careful aquatic plant observations and records will be maintained to determine if complete and/or more frequent drawdowns are required.

Complete drawdowns will be made during the months of July and August. This period should be sufficient to provide bottom aeration and stimulate plant production.

The pool should then be refilled as quickly as possible to provide as much water as possible for the fall migrants and wintering waterfowl.

Proposed Pool Levels for Owens Bay

<u>Year</u>	<u>Mid-March</u>	<u>June 15</u>
1965	11/10.12	11/11.12
1966	do	do
1967	Drawdown during July and August then refill as quickly as possible.	
1968	11/10.12	11/11.12
1969	do	do
1970	do	do
1971	do	do
1972	do	do
1973	do	do
1974	do	do
1975	do	do
1976	do	do
1977	Drawdown during July and August then refill as quickly as possible.	

E. Recommendations.

The water management objective at Lake Andes is to hold as much water as possible to carry it through drought periods. The North and South Units receive most of the runoff water and will normally be filled first.

Seven, ² 58" x 38" pipe ^{Ascent} foot culverts and spillway channel were constructed in 1964 on the west end of the North Dike. The flow line of the lowest culvert is 1436.26, m.s.l., at which point water will flow from the North Unit to the Center Unit. This is .09 foot lower than the crest of the north dike control structure of 1436.35, m.s.l.

The crest of the south unit control structure is 1434.85, m.s.l.

All units are equal at 1437.25, when water will pass from the outlet tube at the south end of the South Unit.

The previous problem of carp entering the lake via the outlet tube has been eliminated by the construction of the fish barrier.

Periodic checks should still be made of the farm ponds in the watershed to insure that no undesirable fish enter the lake during flood waters.

If and when the Wagner Irrigation proposal becomes a reality, this plan will need extensive revision as modified and/or additional control structures will be necessary to manipulate water levels and provide for periodic drawdowns.

Peter S. Suich

Peter S. Suich
Refuge Manager

January 7, 1965

FEB 11 1961

L.A. S.D.
Lake Andes

50 752
H.M.V.

LAKE ANDES NATIONAL WILDLIFE REFUGE
Lake Andes, South Dakota

February 17, 1961

Mr. H. L. Baker
Bureau of Reclamation
Huron, South Dakota

Dear Mr. Baker:

This will answer as best I can, your letter of February 10 regarding the easements on Lake Andes held by this Bureau.

A bit of the early history of the Lake Andes area may help understand the existing situation. Lake Andes has always had considerable fluctuation in levels; the first record of it being dry was in 1878 and by 1882, it was at the highest level recorded. It was extremely low in 1894, high from 1898 to 1924, dry in 1936, high in 1945-54 and dry again in 1959.

Apparently the Lake was low at the time the original survey was made in 1874 as the evidence indicates the meander line was fairly low; the records are confusing as to the exact level. It was finally determined that the meander line should be that elevation of the southeast corner of Section 4, T96N, R65W, 1433.25 msl. -96-455-6124
C.C.S.

During the period 1898 to 1924, the level of the Lake exceeded the meander elevation and encroached upon private lands resulting in claims against the Government for damages. This resulted in a Congressional bill (42 Stat. 990 and Supplementary Acts) passed in 1922 which established a permanent high water mark four feet above the southeast corner of Section 4 (1437.25 msl) to which the level of Lake Andes could be raised and above which it could not be maintained. The Act also appropriated money to construct an artificial outlet which was done by the Forest Service in 1934. This is the concrete tube at the southwest end of the Lake which has a flowline of about 1431.88 and a flashboard control with a crest of 1437.25.

The Government was also called upon to keep the level of Lake Andes up. The first of several artesian wells was drilled by the Government in 1898 to provide water for Indian cattle. The Garden Creek diversion was constructed in 1936 to add 2,560 acres of watershed to the lake. The two rain dikes were constructed in 1941 to concentrate the water in either end and thereby reduce the evapo-transpiration losses.

There appears to have been some question as to the constitutionality of the Act of 1922 as it deprived citizens of rights without due process. Therefore, the Government endeavored to obtain easements for flooding purposes on the four-foot area between 1433.25 and 1437.25. This job was assigned the Bureau of Biological Survey, predecessor of this Bureau, and was completed on approximately 95 percent of the shoreline in 1939-40.

These easements granted the United States "the exclusive and perpetual right and easement to flood with water, and to maintain and operate, and/or to raise the water level of Lake Andes to the permanent high water contour of that lake, for water conservation, drought relief, and for migratory bird and wildlife conservation purposes, and/or upon said lands and waters to operate and maintain a wildlife conservation demonstration unit and a closed refuge and reservation for migratory birds and other wild-life". ".....nothing contained herein shall at any time be construed as to change or modify the riparian rights of the grantor, the freedom of boating by power or otherwise, and the right of fishing, and provided further, that nothing contained herein shall at any future time be construed as including the rights to inundate by means of additional construction on any or all of the above described lands beyond the point and/or area flooded by the completed original structure"

The South Dakota Department of Game, Fish and Parks granted the United States a perpetual easement for similar purposes covering the area of Lake Andes within the original meander line; this easement is dated 25 November, 1939.

Arrangements can be made to have our Branch of Realty provide a map of the area covered by the easements if you desire.

*They are recorded
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with p's //*

The legal status of these easements is in doubt as no record exists of their having been recorded. Our Bureau does not list Lake Andes as an official easement refuge and we operate mainly on the basis of not having been questioned.

The Owens Bay Unit located in Sections 5 and 6, T96N, R64W is owned by the United States.

I can find no record of easements held by other agencies around the shoreline of the Lake.

I trust this has been of some help to you. If additional problems arise that we might be of help on, please feel free to contact us. I would also appreciate being informed of the developments relative to the Wagner Unit.

Yours very truly,

Harvey W. Miller
Harvey W. Miller
Wildlife Biologist

cc: Regional Director, BSWF
Area Supervisor, MRBS

I trust this information is properly presented

